surgical aid. This suggestion of rectal examination as a regular part of the investigation, whether symptoms seem to call for it or not, is by no means a new idea; yet the procedure is constantly forgotten. A careful clinical history should always be obtained; examination of the abdomen in every part should never be omitted; *x*-ray plates after bismuth injections should be remembered in all obscure cases; the discharges from the bowel should be examined not only by gross inspection, but also chemically and by the microscope; and the complete blood count should be made by an expert. But all these means of reaching a diagnosis may fail to reveal the existence of cancer of the rectum, when simple rectal examination would have shown its presence at once.

In conclusion, I repeat the sentences with which this paper began: that in considering the cause of any chronic digestive disorder, cancer can never be left entirely out of account, and can never be eliminated from the calculation until after all the evidence has been obtained and carefully weighed. To this conviction I would add one other, that no examination for any chronic digestive disorder is complete until a rectal examination has been made.

THE ROUTINE EXAMINATION OF THE ŒSOPHAGUS.

By Charles M. Cooper, M.D.,
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Until comparatively recently an analysis of the symptomatology and an examination of the œsophagus with sounds of divers make and form exhausted our means of investigating this tube. The association of the knowledge so acquired, with the postmortem findings, has led to the establishment of certain fundamental facts, an acquaintance with which is essential prior to our investigation.

From such we cull the following:

1. Difficulty of swallowing is the overwhelmingly important symptom indicative of a lesion of, or interference with, the œsophageal tube.

2. Of every 100 patients who come complaining of this symptom, from 60 to 90 suffer from malignant disease. This comprises from 5 to 6 per cent. of all carcinomas. Of persons so afflicted, over 70 per cent. are males. This raises the question whether syphilis does not play as important a role in the etiology of cancer of the œsophagus as it is now believed to play in cancer of the tongue. Of these carcinomas, 10 per cent. arise in the cervical region, 40 per cent. at the bifurcation of the trachea, 30 per cent. at the lower end, while the remaining 20 per cent. are really instances

of gastric carcinoma which have led to œsophageal symptoms. Of the 10 cases which I have seen, 5 occurred at the tracheal bifurcation, 1 in the neck, 2 at the lower end, while 2 were of gastric origin.

3. In interference with deglutition from causes outside the œsophagus, difficulty of swallowing is rarely the first or only complaint, as it not uncommonly is in diseases of the tube itself.

4. The œsophagus is relatively insensitive and therefore severe pain is infrequent in lesions confined to its walls. The acute rending pain, retrosternal, of short duration, which most individuals have experienced on gulping down too quickly too large a swallow of fluid, and which appears to be due to an acute stretching of a segment of the œsophagus, is obviated by the slow method of taking food which these patients quickly learn to practise. Head states that the œsophagus is segmentally connected mainly with the fifth dorsal segment, and that the two maxima brought out by passing a bougie are to be found (*a*) at a spot two inches from the middle line posteriorly at the level of the angle of the scapula, and (*b*) at a spot in the fifth interspace anteriorly about half an inch internal to the nipple line. Skin sensitiveness may be associated with these pains, and overflow into the neighboring dorsal and into the cervical segments may occur. It is only during exacerbations or after the passing of instruments, in my experience, that we can outline these areas and skin segments, and we may conclude that severe pain commonly implies a spread of the disease beyond the œsophageal wall.

5. The œsophagus is not provided with location nerve terminals, and consequently the patients' fixed ideas relative to the seat of the lesion are absolutely untrustworthy. The non-appreciation of this fact has led to errors of localization. Particularly apt is he, no matter where the real lesion, to insist that the delay occurs just above the jugular fossa, as he there feels a choking sensation, perhaps because near this locality the striped constrictor muscles become continuous with the non-striped muscle of the œsophageal wall.

6. Auscultation of the œsophagus as a diagnostic method gives meagre information. As Hertz points out, the factors concerned in the production of the first and second sounds have been probably misinterpreted. The whole subject will bear re-investigation, and meanwhile conclusions drawn from its findings are unreliable. The gurgling murmur clearly audible without auscultating should probably be excepted.

7. Grave organic disease of the œsophagus frequently leads to disturbed innervation of the tube. The clinician who is unaware of this source of error may mistake the complication for the real lesion, and so incorrectly diagnose both the locality and the nature of the disease. I have seen this occur.

8. The amount of dilatation that takes place above a carcino-

matous stricture is relatively small, and the regurgitation of a large quantity (above three ounces) of food from the œsophagus should suggest a cause other than carcinoma. Very little dependence, as I have repeatedly noted, can be placed upon the patient's estimation of the amount he regurgitates. This must be seen and measured. Since free hydrochloric acid is often not to be found in the stomach contents of patients afflicted with œsophageal carcinoma, its absence from the regurgitated food does not prove the latter to come from the œsophagus. The excessive mucous secretion and the unswallowed saliva frequently lead the patient to believe that he regurgitates more food than he actually does.

9. Emaciation to an extreme degree may ensue when swallowing is seriously impaired, though the lesion be non-malignant.

10. Unilateral paralysis of the vocal cord is quite a common occurrence during the course of a carcinoma of the œsophagus. This may be present in the absence of any change of voice.

11. The act of swallowing is reflexly initiated by the contact of the food with the mucous membrane of the posterior portion of the tongue and the fauces. The food is thrown back into the required position by the voluntary elevation of the fore part of the tongue and the contraction of the mylohyoid muscles. In one patient with difficulty in swallowing, whom I was asked to see, this necessary preliminary manœuvre was found to be impossible, and the bismuth capsule lay motionless in the fore part of his mouth. When the bolus has reached the back part of the tongue it is no longer under control, and the involuntary reflex stage of deglutition begins. The peristaltic wave so induced can pass over any muscular block whether caused by lesion, ligature, or section. The loss of the swallowing reflex is clinically indicative of a bilateral lesion, as either both superior laryngeal or both recurrent laryngeal nerves must be paralyzed to prevent the occurrence of deglutition.

The special importance of a full and correct history in this field of work must always be kept in mind. In some instances it is characteristic of the particular lesion from which the patient suffers. I would draw attention to two sources of error: (*a*) Since carcinomas frequently develop on the site of old lesions or in the course of other chronic diseases, such as cirrhosis of the liver, the immediate trouble may be regarded as having been of much longer duration than is actually the case, and so an unduly favorable diagnosis made. (*b*) Carcinoma of the œsophagus is an incurable disease. The patients receiving little help, visit many physicians. Some have argued with them the reasons for the different diagnostic possibilities. The patients desirous of believing that they suffer from the least serious malady will narrate to a physician whom they later see a history strangely at variance with the real facts.

THE CLINICAL EXAMINATION. It may seem trite to emphasize the fact that a thorough clinical examination should always precede all the special methods of investigation. Nevertheless, so frequently is this left undone in private practice, clinic, and hospital work, that it must be that in our teaching we have failed to inculcate sufficiently the value of a system in diagnostic work. Of special importance is it to emphasize this in diseases of the œsophagus, for many of the patients so afflicted first find their way into the surgical clinic, where the gullet sounds are always handier than the percussion finger or the stethoscope. With the dissemination of the knowledge of the diagnostic value of the *x*-rays and of the œsophagoscope, some patients will first visit the radiographer, whose clinical experience is commonly of a meagre character, and who, overconfident of his results, may wrongly interpret what he thinks he sees; other patients will seek the specialists in throat diseases, from whom, indeed, has come the impetus in œsophagoscopic work. They, little practised in the art of general clinical examination, will be often tempted to œsophagoscope these patients without first having them thoroughly investigated from the clinical standpoint. If this should occur, some aneurysms will be ruptured and perhaps some œsophageal walls perforated.

After the clinical examination we proceed to examine the larynx and pharynx with the laryngoscope. Any cord paralysis or laryngeal abnormality is noted. By assuming Killian's position we can look down the trachea. By carrying out the manœuver of von Eicken after cocainizing the larynx we can, without distressing the patient, examine the hypopharynx, that is, the part of the pharynx which lies below the aperture of the larynx. If nothing abnormal be evident, the patient massages his throat below this level in an upward direction, and I have seen the saliva which does not pass the stricture re-appear in the pharyngeal slit. In a certain percentage of cases a portion of the growth may be thus seen blocking the hypopharynx, and the physician will be saved the humiliation of unwittingly passing the œsophageal tube, or maybe food in the larynx. In some cases it is better to delay considering hypopharyngoscopy until after the radiographic investigation has been carried out. It may not then be necessary.

If our examination so far be negative, we watch our patient as he tries to swallow, first, a mouthful or two of fluid and later some bread. We note if the voluntary contraction of the mylohyoid muscles and the accompanying elevation of the larynx occur, and if the involuntary part of the deglutition act ensue. After the patient has swallowed as much food as he can, we note:

1. If there be any change in the shape of the neck; if by shaking the patient's throat we can produce a succussion murmur. This was readily obtained in one of the cases of œsophageal diverticulum and led to the recognition of the seat of the mischief. Or if, after giving the patient two or three bismuth capsules, they can be massaged from the lower part of the neck into the pharynx. This

was easy of accomplishment in another case of œsophageal diverticulum, and similarly led to the discovery of the diverticulum.

2. If the laryngeal picture has changed. In one patient the filled diverticulum so displaced the larynx that the cord ran from behind forward, and to the left instead of directly forward, as they did before the sac was filled.

3. If there be any change in the character of his radial pulse from that exhibited prior to his eating. In one patient whom I saw, and who had a diverticulum, the filled sac evidently compressed the big vessels, particularly during deep expiration. If the diverticulum be in the neck region, it is the carotid and jugular pulse that should be inspected.

The patient is now referred to the x-ray department before any bougie or metal tube is passed.

THE X-RAY EXAMINATION OF THE ŒSOPHAGUS. The normal œsophagus throws no shadow, and it is only after introducing within it some substance or object impermeable to the rays that we are able to locate their position and study their form and function. Even with this aid the shadow cast in the anteroposterior position by that portion of the œsophagus lying below the arch of the aorta is often indistinguishable from the shadows due to the vertebral column and the overlying descending thoracic aorta.

In the left posterior or right anterior positions, the dark shadows due to the vertebral column, on the one hand, and to the heart and aorta, on the other, are separated by a clearer area, which is termed the clear middle area. Through this field the normal œsophagus runs, and it is this area that we investigate. The supra-aortic portion of the œsophagus is best investigated in the anteroposterior position.

Most of the better known röntgenologists agree that fluoroscopy is the method of choice in the x-ray investigation of diseases of the œsophageal tube. Having followed this line of work as an aid to clinical diagnosis, rather than as a branch sufficient unto itself, while recognizing the high value in skilled hands of the screen, and especially of orthodiagraphic work, I believe:

1. That fluoroscopy is a procedure dangerous to the operator, and necessitates the expenditure of too much time to render its adoption likely for general clinical work.

2. That many clinicians are not prepared to accept reports emanating from the x-ray room which are not based upon shadows which can be registered on the photographic plate, and so at least be open to the inspection of the physician.

3. For teaching purposes it is necessary to register the abnormality if one desires sufficiently to impress the student with the value of this method of examination.

We proceed as follows:

1. If the previous examination leads us to suspect the presence of a supra-aortic œsophageal pouch, we ask the patient to swallow

two or three teaspoonfuls of a mixture made up of equal parts of bismuth subcarbonate or bismuth oxychloride and sugar of milk, to which sufficient water is added to give it a paste-like consistency. We then make a radiogram as of the lung apices, using the compression diaphram, the lower edge of which rests on the manubrium sterni. Fig. 1 is of such a patient in whom this procedure was adopted. The bismuth-filled pouch is very evident. It is cleanly bordered and has no funnel-shaped opening running downward from its base, this serving to distinguish it radiographically from the local dilatations which may form immediately above œsophageal strictures.

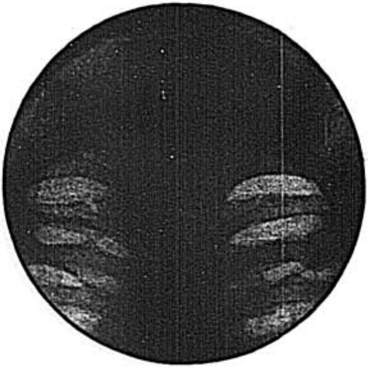
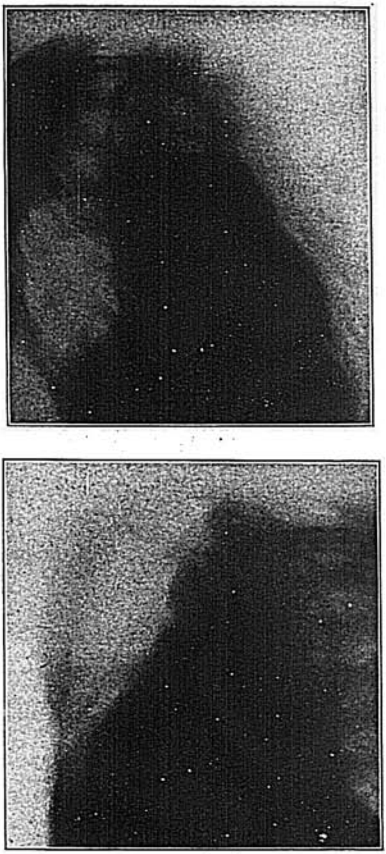


FIG. 1 is from a patient seen in consultation with Dr. Terry. The complaint was difficulty of swallowing. The clinical examination revealed a gurgling murmur on swallowing, and a succussion splash after drinking and shaking the neck. The radiogram was taken after bismuth paste had been swallowed. The diverticulum is very distinct. The marker is over the cricoid. The œsophagoscope showed an absence of ulceration or malignant change. The sac was later removed by Dr. Wallace I. Terry.

2. If we suspect the presence of a pouch lying below the level of the aortic arch, we administer bismuth paste, and then radiograph the patient in the right anterior oblique position. The pouch will show the same characteristics, but appears in the clear middle area, of which I have spoken.

3. If we suspect the presence of a spasmodic contraction of the cardia with an accompanying œsophageal dilatation, we ask the patient to drink as much as he can of a pint of koumiss with which an ounce of bismuth subcarbonate has been well mixed. The suspension is well shaken immediately prior to use. The patient is then at once radiographed in the right anterior oblique position.



FIGS. 2 and 3 are from a patient seen through the kindness of Dr. Kugeler. The original complaint was vomiting of considerable blood. The clinical findings were an alcoholic history, a large spleen, a small liver, and hemorrhoids. The diagnosis was cirrhosis of the liver. Later there was complaint of difficulty of swallowing. A clinical examination for a cause was negative The sound was arrested at the cardia. The plates are explained in the text. Œsophagoscopic examination was arranged for, but was not carried out, and later was considered inadvisable. Later, there was paralysis of the right vocal cord, coughing up of a cupful of pus, and death. The postmortem revealed carcinoma of the œsophagus, as described; a peri-œsophageal abscess which had ruptured into the bronchus and into the pericardial sac; cirrhosis of the liver.

The bismuth-containing œsophageal sac stands out very distinctly and may fill almost the whole of the clear middle area.

4. If we suspect the presence of a carcinoma of the œsophagus, we ask the patient to swallow a few teaspoonfuls of the bismuth paste and then one or two capsules each containing seven and one-half grains of bismuth subcarbonate. The patient is then radiographed in the right anterior oblique position.

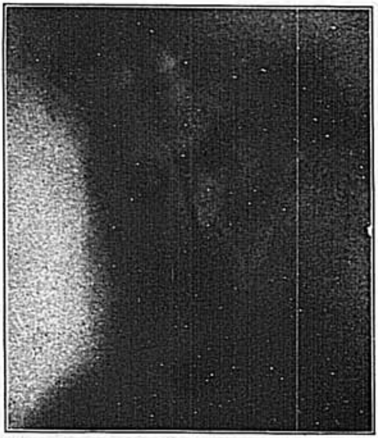


FIG. 4 is from a patient seen in consultation in whom a diagnosis of an œsophageal diverticulum had been made, being based upon a falsified history, the patient's invincible belief that the obstruction lay at the level of the jugular fossa, an occasional hindrance to the tube about this level, and a wrongly interpreted x-ray plate. The clinical examination showed great emaciation, no enlarged glands, no pupillary or laryngeal changes, no palpable stomach tumor, no systemic changes. Bismuth capsules were administered. With the fluoroscope one lost track of them in the upper part of the gullet. The bismuth, however, collected and became evident at the cardiac end of the œsophagus. The gelatin capsules evidently softened and allowed the bismuth to escape at the point where the bismuth streak begins. The œsophagoscopic examination showed a normal œsophagus. A probable diagnosis was made of spasmodic stricture of the cardia, dependent upon a malignant growth below. Operation was advised and performed. A large malignant growth infiltrating the stomach walls and situated up under the liver margin was found. Jejunostomy was done. Death occurred a week later. The postmortem revealed the œsophagus not involved in the growth

Figs. 2 and 3 are of a patient who died from a carcinoma of the œsophagus. In Fig. 2 two bismuth-containing capsules are evident. They are arrested at the upper limit of the growth. In Fig. 3 the shadow cast by the bismuth paste is seen. The œsophageal lumen is alternately dilated and constricted, but the bismuth paste shadow is continuous. Postmortem the œsophageal wall from the level of the tracheal bifurcation to the cardiac end was found to be involved, much of the growth, however, having ulcerated away. After these radiograms were taken a peri-œsophageal abscess formed and opened into the trachea and later into the pericardial cavity.

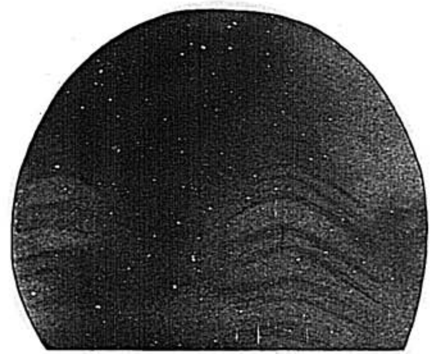


FIG. 5 is from a patient, aged sixty-five years. The complaint was shortness of breath of eight years' duration, difficulty in swallowing, and angina-like pains of a year's duration. The clinical examination gave evidence of the presence of general arteriosclerosis and of some bronchitis. A gurgling murmur was heard on swallowing. A succussion neck splash was produced after swallowing fluids. Laryngoscopy after swallowing bismuth paste showed a displacement of the vocal cords, as described. Hypopharyngoscopy was negative. The radiogram taken after swallowing bismuth paste shows the diverticulum filled with the bismuth mixture. The passage of the tubes was resisted at the cricoid, and regurgitation of food ensued. Œsophagoscopy showed a spasm of the œsophagus just below the pharyngeal slit, due to the presence of a little grayish slough, which had been probably produced by a previous œsophagoscopy (he had been previously œsophagoscoped twelve times, and no diagnosis arrived at); below that the mouth of a diverticulum, which was only evident when the sac was filled with bismuth paste; and below that in the upper thoracic portion of the œsophagus, a stricture with a curved semilunar opening situated at the side. This lower stricture is difficult of explanation, but further fluoroscopic and radiographic examination suggests that a mediastinitis involving the pericardium and the œsophagus is present in this patient. The patient is still under observation.

In other cases of carcinoma the plate shows a shadow similar to that thrown by the bismuth-filled diverticulum, but there is a funnel-shaped prolongation of the bismuth shadow through the stenosed area. Sometimes below the constriction the shadow broadens out again, there occurring a complicating spasm of the cardia, which temporarily delays the entrance into the stomach of the bismuth paste which has passed the stricture (see Fig. 6). Sometimes capsules are arrested at places past which the sound is found readily to glide, as in this case. When this occurs we suspect a paralysis of the muscular fibers of the œsophagus or perhaps their destruction, or an intermittent spasm.

5. If we suspect a narrow stricture, and wish to determine if there be a local dilatation above it, we can administer one of the capsules. This will block the opening. If the patient then swallows as much bismuth paste as he can, a radiogram will show the extent of the dilatation.

6. If the history and previous examination has rather suggested an extra-œsophageal cause for the difficulty of swallowing, or has led to no tentative diagnosis, we make two radiograms after the patient has taken the bismuth capsule and bismuth paste, one in the anteroposterior direction during suspended respiration, the plate to include the region of the neck; the other radiogram is made in the right anterior oblique position. One or both of these plates will show the seat of delay and give valuable information regarding the nature of the underlying lesion. If an aneurysm or mediastinal tumor be evidently present, they will show whether its position corresponds to the point at which the bismuth is delayed.

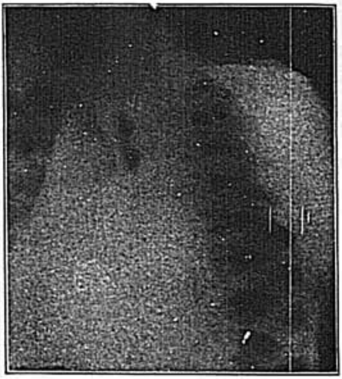


Fig. 6 is from a patient aged fifty years. The complaint was difficulty in swallowing, of three months' duration. The clinical examination showed as positive findings a fœtid odor to the breath, a dilated right pupil, an old right corneal scar, a secondary anemia, and a very slow method of eating; later, spitting up of blood. Laryngoscopic examination, etc., was negative. Bismuth paste and bismuth capsules were administered and a radiogram made. The print has been described in the text. The passing of sounds and œsophagoscope was deemed inadvisable until the former should be therapeutically required. A diagnosis of carcinoma of the œsophagus at the level of the tracheal bifurcation was made.

(Note.—If only bismuth paste were administered, and no spasm of the lower end of the œsophagus were present, a radiogram might give no evidence of the stricture.)

The further investigation, if any, depends upon the tentative conclusion that is formed after the association of the clinical and radiographic data:

1. If we conclude that an aneurysm is present, no further investigation is required or indeed justifiable.

2. If an aneurysm be present, but the location of the stricture be below the aneurysmal sac, no further investigation is justifiable, as the sac of the aneurysm might be ruptured.

3. If we are convinced that a carcinoma of the œsophagus is present, the less the instrumental meddling the better for the patient. The passage of instruments is only called for when their use is demanded for therapeutic purposes.

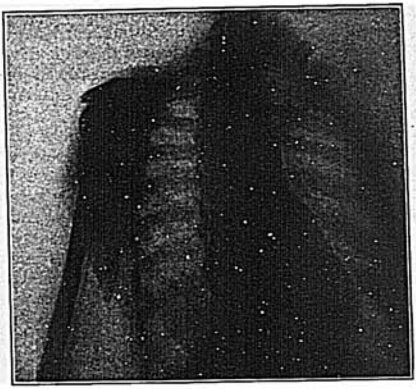


Fig. 7.—A capsule is seen lying behind the shadow due to the arch of the aorta. Bismuth paste and a large-bore stomach tube were passed without difficulty. A temporary retention of a capsule in this portion is not infrequent. Œsophagoscopy was considered inadvisable.

If further investigation be advisable, examination with the sound and the œsophagoscope is now in order. The passing of the sound should precede that of the œsophagoscope. Thus, we learn if the diameter of the gullet above the spot at which the capsule is arrested will allow of the passing of a tube of the diameter of the œsophagoscope.

The best bougies are probably those having a whalebone handle and interchangeable olive-shaped metallic heads of different sizes. They are neither too rigid nor too flexible. The method of use and the information they afford in cases of œsophageal carcinoma, œsophageal spasm, and stricture from extra-œsophageal causes other than aneurysm are well known and need no comment.

Œsophagoscopy is the last diagnostic means in this proposed scheme. It is a method often disagreeable to the patient, and if done roughly or inopportunely, of considerable danger. Its employment demands a wise discretion and good sense on the part of the operator.

The technique of the examination is as follows:

1. The stomach should be empty, and the œsophagus, if dilated, should be washed out. No sound should have been passed for at least twenty-four hours.
2. An injection of $\frac{1}{4}$ grain of morphine and $\frac{1}{100}$ grain of atropine is given half an hour previously.
3. The structures of the throat are well anesthetized with a 10 per cent. solution of β-eucaine with adrenalin.

The patient may be examined in the sitting, left lateral, or dorsal position. I prefer, when possible, to have the patient seated on a cushion on the floor. The back and feet are placed against firm supports; another cushion is put under the knees. An assistant supports the head, which is dorsally flexed.

The patient is told to breathe quietly; to swallow when told to do so; to raise his hand if in pain, since he cannot speak; and to pay no attention to drooling saliva.

I use the Einhorn instrument, which carries its own light. I watch its passage over the back of the tongue past the epiglottis into the pharyngeal slit. The mandrin is then introduced and the instrument is carried past the inferior constrictor. The mandrin is then withdrawn and the further progress of the instrument watched. The previous investigation will have told us what bore instrument can be used and the length of instrument to be chosen. It is carried to the site of the lesion.

The appearance of the lesion is in many instances quite characteristic: the wrinkled sac of a diverticulum, the rosette-like appearance occasioned by a local spasm, the bleeding ulcerated nodules of a carcinoma if seen are readily recognized. In other instances the picture presented by extra-œsophageal growths is exactly similar to that seen in some cases of carcinoma.

The object of this paper, however, is not to describe the correct technique of, or the information gained by, hypopharyngoscopy, probing with sounds, and œsophagoscopy, and I have purposely refrained from speaking of double sounds and apparatus for determining the intra-œsophageal pressure. Rather it is threefold:

1. To record how simply one can often clinically gain serviceable information in cases of œsophageal diverticulum.
2. To show that radiography can be of considerable service in the investigation of these patients.
3. To advocate the adoption of the above outlined system in the investigation of patients afflicted with difficulties of deglutition. It will, I believe, prevent some deaths and will undoubtedly save much distress to a class of patients who already suffer much. Its advantage for teaching purposes is obvious.

THE GASTRIC SECRETION.

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Perhaps no one field in physiological or pathological chemistry contains more of interest than the results of a systematic investigation of the gastric secretion. This paper is based on a study of the vomitus from 81-patients, mostly derived from postanesthetic vomiting. No food particles were present in any of the specimens, for in Mount Sinai Hospital, as in other institutions, food and water are withheld for several hours before the patient is anesthetized. The results, as one can see from the tables, are of some interest and at some variance with opinions held by other observers.

Taking up the first of the columns, we find that the amounts vary from 20 c.c. to 240 c.c. This variance unquestionably is an individual one dependent on the length of the anesthesia, thereby influencing the amount of mucus swallowed, the watery element acting as a chemical stimulant; the psychical effect of both operation and anesthesia, the nervous temperament, etc., of the patient, all or each of which may influence the amount of gastric secretion. Larger amounts of gastric secretion may also be due to an existing functional condition or to a transudation following an abnormal resorptive power. Normally the fasting stomach may contain 10 to 20 c.c. of fluid.

The color question was also of interest: it was brown in 22, green in 37, colorless in 6, yellow in 7, gray in 8. Very few were perfectly clear, mostly all being turbid from the mucus present. Of the 37 green specimens, only 32 contained bile, thus confirming the opinion that not every green stomach contents is caused by the presence of bile. Mucus in various amounts is also influenced by some of the causes which tend to increase the amount of gastric secretion. It may be caused by mouth lesions—stomatitis, ptyalism, pharyngitis, etc.—or by a catarrhal gastritis. Normally, there is always a little mucus present. In 6 there was no mucus, little in 37, moderate in 13, and much in 25.

The normal chemical reaction of the gastric secretion is acid, due to the presence of free acid, partly to acid salts (monophosphates), and partly to both. In the 81 specimens, 66 were acid to litmus, 9 were alkaline, and 5 were neutral.

The Congo paper reaction was positive in but 27 and negative in 53. This reaction is very generally used to determine the presence of free acids, and one is somewhat struck by the fact that 66 of the specimens were acid to litmus and but 27 of these positive to Congo, assuming that the gastric acidity is due to the free acids present.